



You Can Dig It!  
Getting to Know the Soils  
Living in our Gardens

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# Soil texture and drainage



Soil texture	Infiltration rate, inches per hour
Sand	2 - 4
Sandy loam	1 - 3
Silt loam, loams	0.25 – 1.5
Silty clay loams, clay	0.1 – 0.3

# What plants grow in sandy soils?







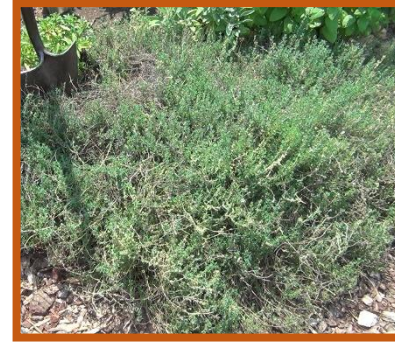
Lavender



Potato



Thyme



Rosemary



Asparagus



Watermelon



Beans



Cucumber



Juniper



Pearly everlasting



Native wild strawberry



# What plants grow in clayey soils?



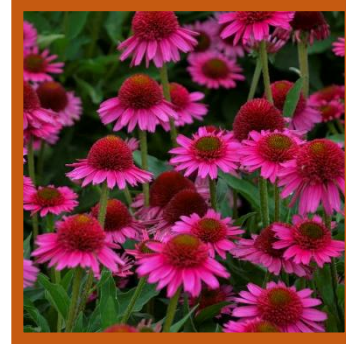
Daylily



Hosta



Coneflower



Black-eyed Susan



Bee Balm



Butterfly weed



False Sunflower



Big Bluestem



Ostrich fern



Switch grass



Broccoli



If your soil is too sandy, should you add clay?

**No!**

If your soil is too clayey, should you add sand?



**So how do you improve  
your garden soils ?**

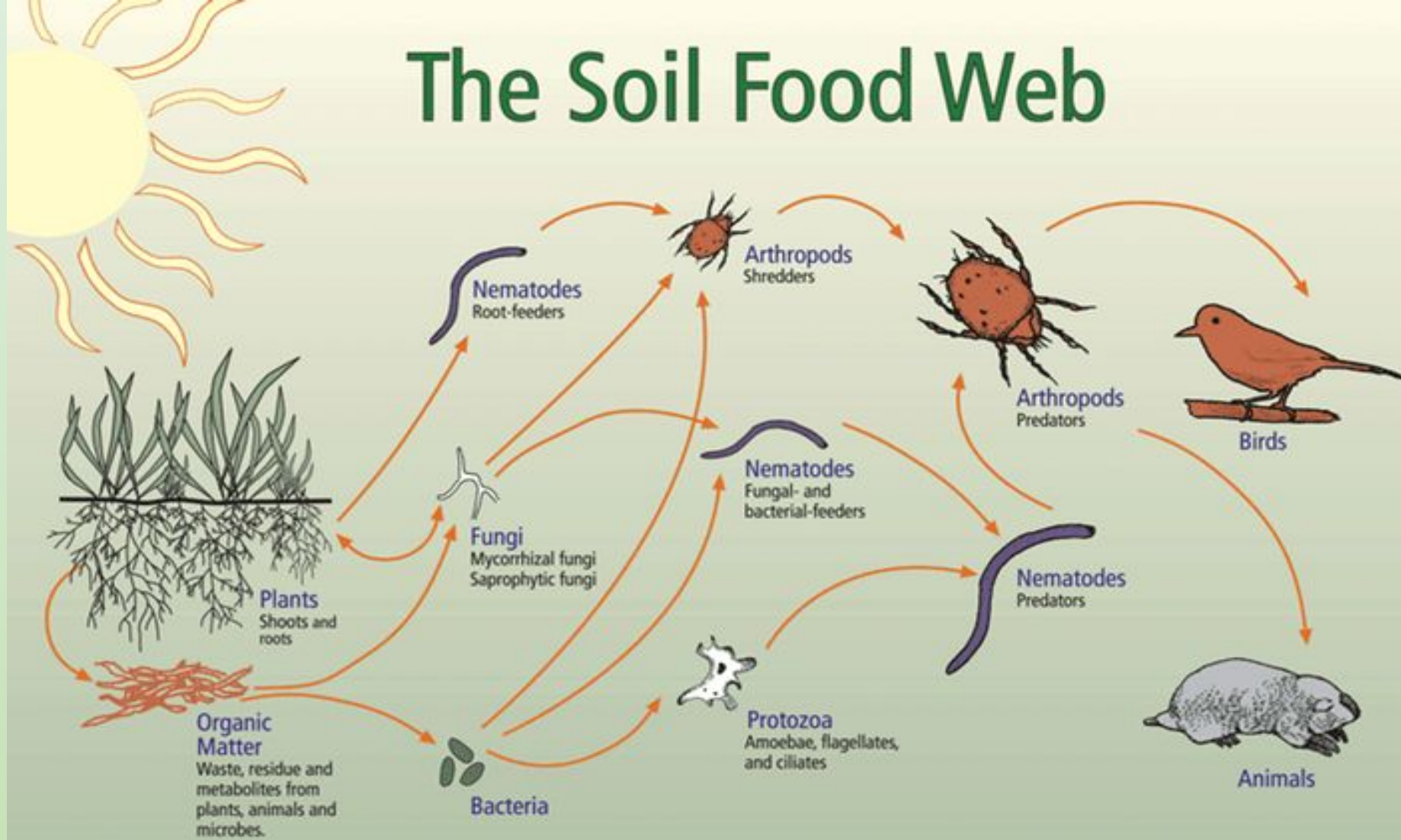


- Compost
- Leaves
- Mushroom Compost
- Old animal manure
- Garden and lawn clippings
- Mulch
- Kitchen scraps
- Peat
- Worm castings

*These are all good  
to add to your soil*



# The Soil Food Web



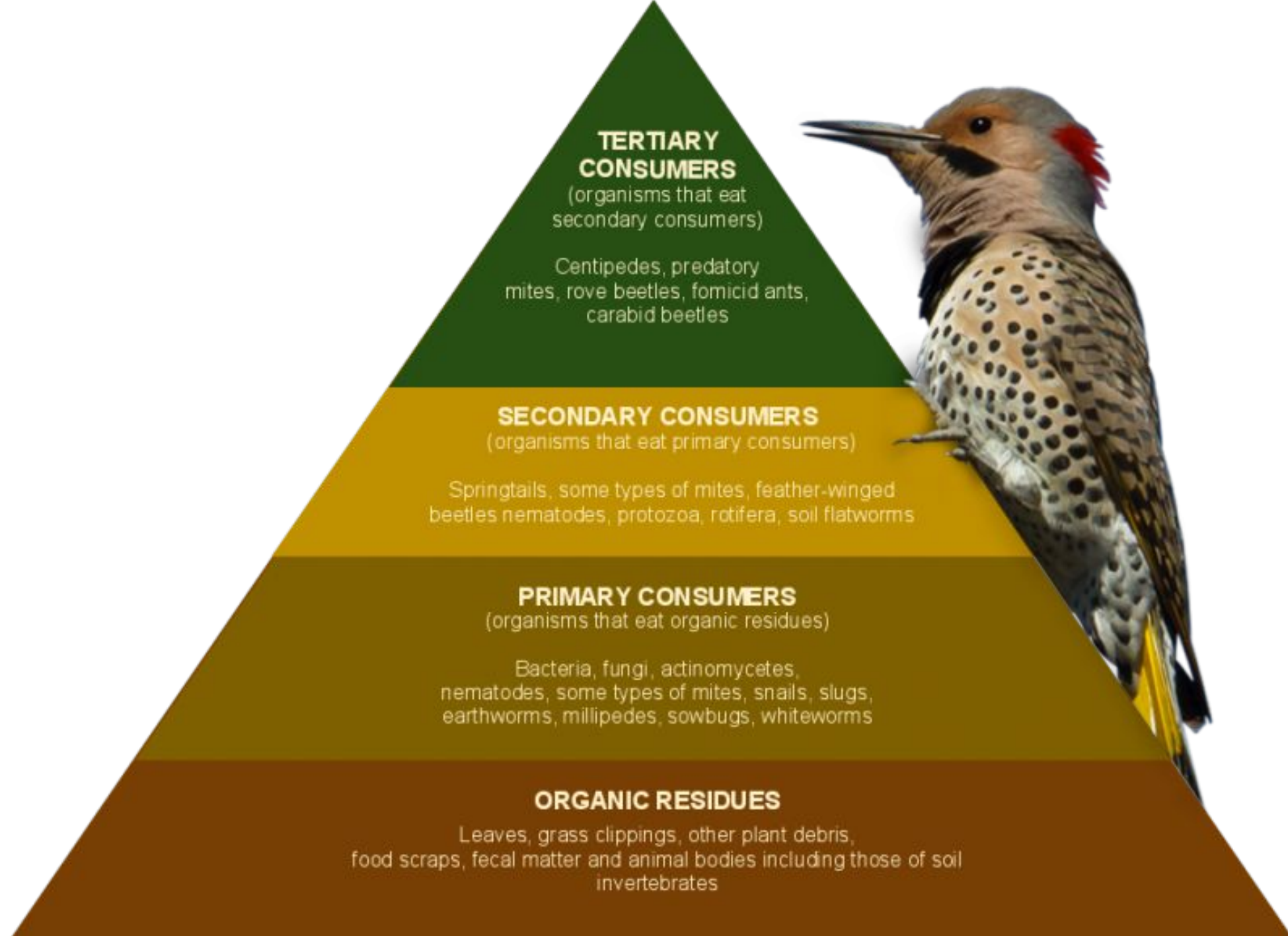
First  
trophic level:  
Photosynthesizers

Second  
trophic level:  
Decomposers  
Mutualists  
Pathogens, Parasites  
Root-feeders

Third  
trophic level:  
Shredders  
Predators  
Grazers

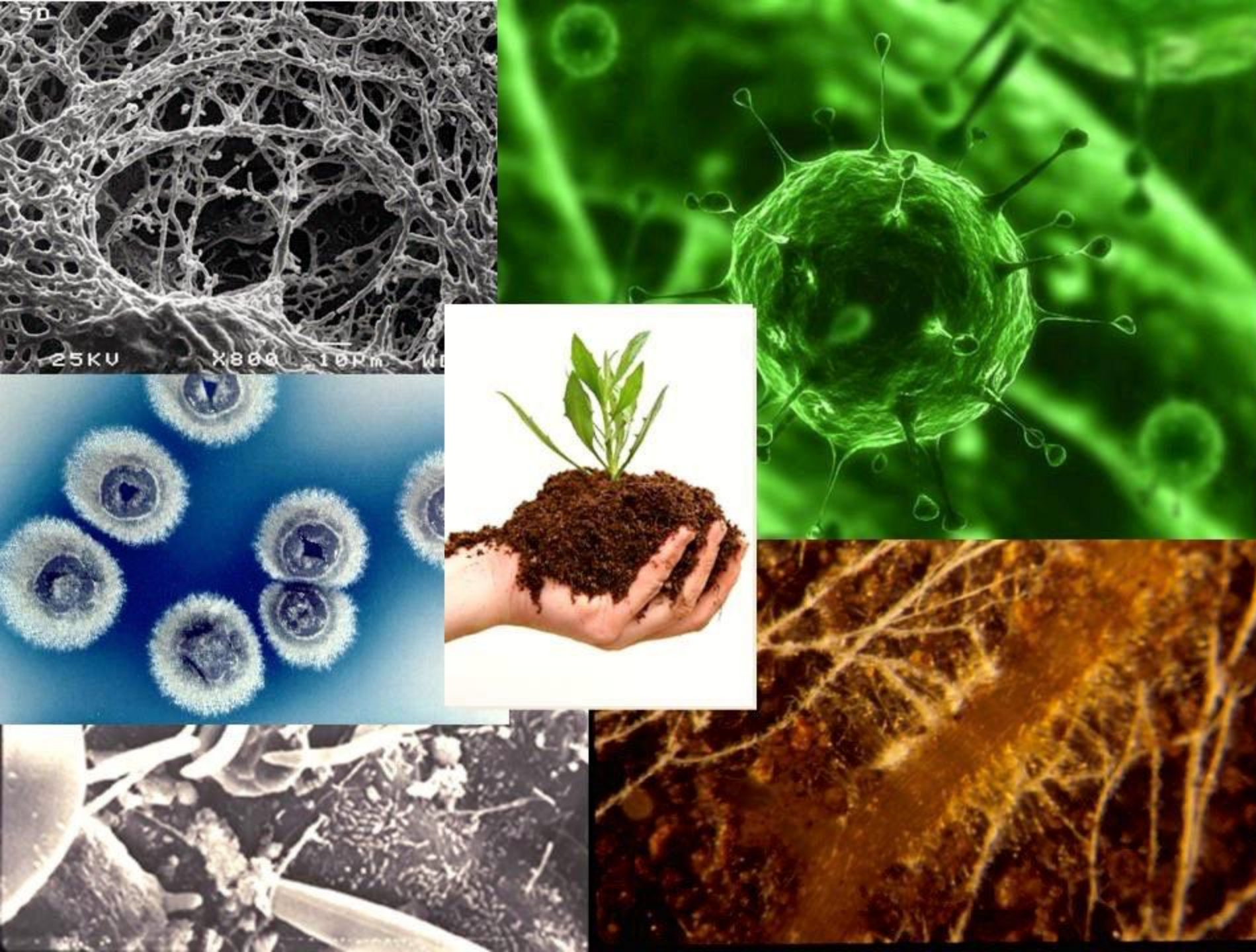
Fourth  
trophic level:  
Higher level  
predators

Fifth and higher  
trophic levels:  
Higher level  
predators

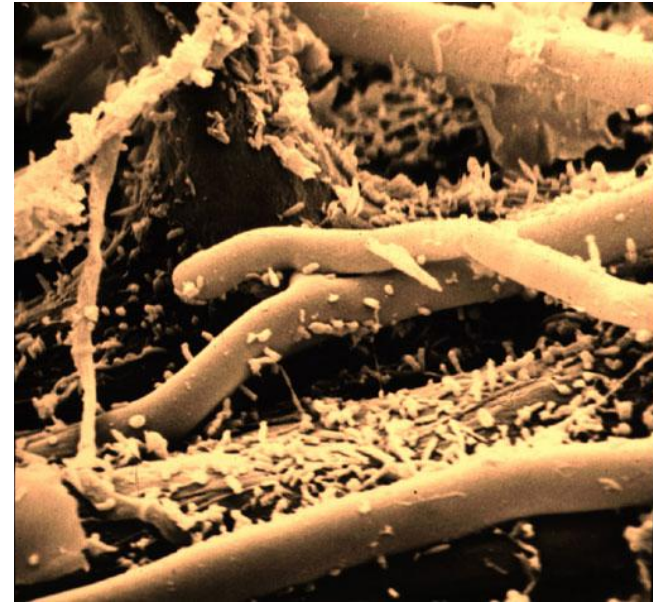


# Bacteria

- **Decomposers**
- **Nitrogen fixers**
- **Disease suppressors**
- **Actinobacteria**
- **Sulfur oxidisers**
- **Aerobes**
- **Anaerobes**



# Fungus



**Decomposers**

**Mutualists**

**Pathogens**

# Beneficial Invertebrates



A close-up photograph of a soil profile. The top layer shows green grass and a small white flower. Below the surface, the soil is dark brown and crumbly, with many roots visible. The text is overlaid on the soil.

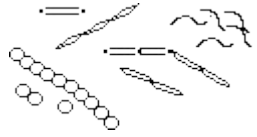
To grow a thriving Garden

Treat your soils with gratitude

Treat them gently for the life within them is vast

Soils know the teachings of Reciprocity

## Bacteria



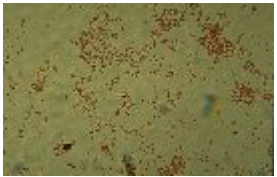
Bacteria are the smallest living organisms and the most numerous in compost; they make up 80 to 90% of the billions of microorganisms typically found in a gram of compost. Bacteria are responsible for most of the decomposition and heat generation in compost. They are the most nutritionally diverse group of compost organisms, using a broad range of enzymes to chemically break down a variety of organic materials.

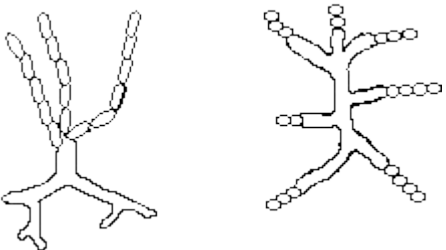
\_Bacteria are single-celled and structured as either rod-shaped bacilli, sphere-shaped cocci or spiral-shaped spirilla. Many are motile, meaning that they have the ability to move under their own power. At the beginning of the composting process (0-40°C), mesophilic bacteria predominate. Most of these are forms that can also be found in topsoil.

\_As the compost heats up above 40°C, thermophilic bacteria take over. The microbial populations during this phase are dominated by members of the genus *Bacillus*. The diversity of bacilli species is fairly high at temperatures from 50-55°C but decreases dramatically at 60°C or above. When conditions become unfavorable, bacilli survive by forming endospores, thick-walled spores that are highly resistant to heat, cold, dryness, or lack of food. They are ubiquitous in nature and become active whenever environmental conditions are favorable.

At the highest compost temperatures, bacteria of the genus *Thermus* have been isolated. Composters sometimes wonder how microorganisms evolved in nature that can withstand the high temperatures found in active compost. *Thermus* bacteria were first found in hot springs in Yellowstone National Park and may have evolved there. Other places where thermophilic conditions exist in nature include deep sea thermal vents, manure droppings, and accumulations of decomposing vegetation that have the right conditions to heat up just as they would in a compost pile.

Once the compost cools down, mesophilic bacteria again predominate. The numbers and types of mesophilic microbes that recolonize compost as it matures depend on what spores and organisms are present in the compost as well as in the immediate environment. In general, the longer the curing or maturation phase, the more diverse the microbial community it supports.

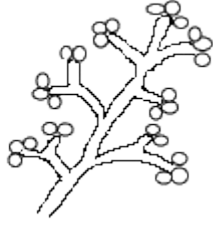
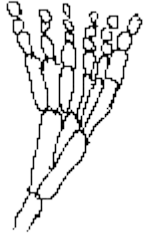
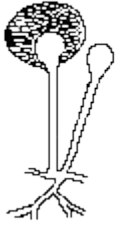




## **Actinomycetes**

The characteristic earthy smell of soil is caused by actinomycetes, organisms that resemble fungi but actually are filamentous bacteria. Like other bacteria, they lack nuclei, but they grow multicellular filaments like fungi. In composting they play an important role in degrading complex organics such as cellulose, lignin, chitin, and proteins. Their enzymes enable them to chemically break down tough debris such as woody stems, bark, or newspaper. Some species appear during the thermophilic phase, and others become important during the cooler curing phase, when only the most resistant compounds remain in the last stages of the formation of humus.

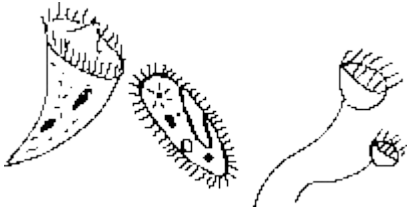
Actinomycetes form long, thread-like branched filaments that look like gray spider webs stretching through compost. These filaments are most commonly seen toward the end of the composting process, in the outer 10 to 15 centimeters of the pile. Sometimes they appear as circular colonies that gradually expand in diameter.



## Fungi

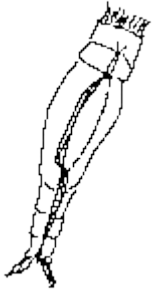
Fungi include molds and yeasts, and collectively they are responsible for the decomposition of many complex plant polymers in soil and compost. In compost, fungi are important because they break down tough debris, enabling bacteria to continue the decomposition process once most of the cellulose has been exhausted. They spread and grow vigorously by producing many cells and filaments, and they can attack organic residues that are too dry, acidic, or low in nitrogen for bacterial decomposition.

Most fungi are classified as saprophytes because they live on dead or dying material and obtain energy by breaking down organic matter in dead plants and animals. Fungal species are numerous during both mesophilic and thermophilic phases of composting. Most fungi live in the outer layer of compost when temperatures are high. Compost molds are strict aerobes that grow both as unseen filaments and as gray or white fuzzy colonies on the compost surface.



### **Protozoa**

Protozoa are one-celled microscopic animals. They are found in water droplets in compost but play a relatively minor role in decomposition. Protozoa obtain their food from organic matter in the same way as bacteria do but also act as secondary consumers ingesting bacteria and fungi.



### **Rotifers**

Rotifers are microscopic multicellular organisms also found in films of water in the compost. They feed on organic matter and also ingest bacteria and fungi.

# Simple PLANT DEFICIENCY Guide

## Calcium

New leaves misshapen or stunted.  
Existing leaves remain green.

NEW GROWTH

## Iron

Young leaves are yellow and white  
with green veins. Mature leaves are  
normal.

## Nitrogen

Upper leaves are light green  
where lower leaves are yellow.  
Bottom or older leaves are yellow  
and shrivelled.

OLD GROWTH

## Potassium

Yellowing at the tips and edges,  
usually in younger leaves. Dead or  
yellow patches develop on leaves.

## Carbon Dioxide

White deposits on leaves.  
Stunted growth, and plant die  
back.

## Manganese

Yellow spots and or elongated  
holes between veins.

## Phosphate

Leaves are darker than  
normal and loss of leaves.

## Magnesium

Lower leaves turn  
yellow from outside  
going in, veins remain  
green.



